REMARKS

Applicants' claims were rejected in the office action of February 5 as indefinite under 35 USC 112 for reciting a "collision detection system" but not sufficiently disclosing how "estimating a crossing location" results in detecting a collision. Applicants' new set of claims recites "a target crossing location estimator for a vehicle." Such an estimator, as claimed by applicants, has utility in determining an estimated crossing location on a baseline defined by a pair of sensors in separated locations on a vehicle. This location can then be used to determine whether a collision is likely, by comparing the crossing location with a constant related to the width of the vehicle and an estimated width of the sensed object, or to determine the center point of such a collision on the vehicle. Determinations of this kind are useful in initiating a variety of accident avoidance and/or occupant protection systems. Applicants thus assert that the 35 USC 112 rejection is moot with respect to the claims now presented.

Applicants' claims were further rejected as anticipated under 35 USC 102(b) over US 6,067,031 to Janky et al. Applicants cancel the rejected claims without prejudice and presents new claims 23 – 27 covering one embodiment of their invention and claims 28 – 31 covering another embodiment of their invention. Applicants assert that their newly presented claims are neither anticipated nor obvious over the Janky reference.

Applicants claim a target crossing location estimator for a vehicle using a pair of object sensors separated along a baseline. The target crossing location is a point on the baseline, and the target crossing location is determined with only range and range rate signals – and specifically without requiring azimuth angle ("bearing angle" in Janky) signals. This determination is performed in a processor configured with either one of two algorithms devised by applicants to provide such determination requiring only range and range rate signals from the sensors but requiring at least range signals from both sensors.

This partial description is sufficient to begin an examination of the Janky reference on which, alone, Examiner bases the 35 USC 102(b) rejections of the previous office action.

Janky's first embodiment deals with a pair of vehicles V1 and V2 traveling in the same direction as shown in Janky Figure 1. In this system a single sensor on vehicle V1 provides range and range rate signals of the detected vehicle V2 preceding vehicle V1 along the road and applies them to a processor configured with a separation maintenance algorithm. The system does not estimate a target crossing location for vehicle V2 on a baseline defined by two laterally spaced sensors on vehicle V1 because vehicle V1 does not have two laterally spaced sensors – since the system is not at all concerned with estimating such a target crossing location in the first place. The Janky reference <u>assumes</u> that the vehicles will collide if the range between them decreases to zero and is designed to maintain their separation by control of vehicle V1 so that this does not occur. This embodiment clearly does not anticipate any of applicants' claims.

Janky's further embodiments deal with a situation as shown in Figure 3. In this embodiment, vehicle V1 may have up to three sensing modules. Module 81 is mounted at the front center of the vehicle and provides range and range rate information on objects to the front of the vehicle such as vehicle V2, which is shown as directly in front of – in the same lane as – vehicle V1. Module 83 is mounted on the right side of vehicle V1 and is disclosed as sensing vehicle V3 in the lane to the right of that in which vehicle V1 is proceeding. Module 85 is mounted on the left side of vehicle V1 and is disclosed as sensing a vehicle V4 approaching from the left on a different road that intersects the road on which vehicle V1 is proceeding at a point ahead of vehicle V1.

In the situation shown, several embodiments and scenarios are described in which an object is sensed and its motion analyzed to determine a possible collision with vehicle V1; <u>but in every embodiment and scenario, the</u>

sensing and analysis are dependent on a single external sensing module, with no help from any other module.

Module 81 is used only to sense the range and range rate of vehicle V2, and vehicle V2 is not described as being sensed by either of modules 83 or 85. Also, since vehicle V2 is shown as being ahead of vehicle V1 in the same lane and collision is assumed if the vehicle attempt to occupy the same longitudinal position, there is no need to estimate a target crossing point on a baseline defined by two sensors. Essentially, this is just a repeat of the first embodiment described above.

Vehicle V3 is described as being sensed only by module 83. Since Vehicle V3 is in a separate lane parallel to that of vehicle V1, Janky describes an algorithm to detect whether or not a collision is likely to take place; but this algorithm begins, in equations 28 – 30 near the bottom of column 9, by using the bearing (azimuth) angle ø(t;1;3) signal output by module 83 to help determine the location in two dimensions of vehicle V3 relative to vehicle V1 and proceeds further to use the bearing angle rate ∂(ø(t;1;3)/∂t signal to determine the relative X (longitudinal) and Y (lateral) closure rates between vehicles V3 and V1. With this information from module 83, no information from another sensor is required.

Janky then performs some comparisons to determine (1) whether or not V3 is approaching V1 in the X (longitudinal) direction (passing or being passed, (2) whether or not V3 is approaching V1 in the Y (lateral) direction (lane changing). But, with careful examination of this series of equations and description from column 9, line 61 to column 11, line 17, Examiner will find that the only variables present representing an external object are those of vehicle V3 sensed by module 83. In particular, module 85 cannot sense vehicle V3 because it is mounted on the opposite side of the vehicle; and, regardless of whether or not module 81 is capable of sensing vehicle V3 (and there is no disclosure that it is), Janky does not disclose receiving or using any information about vehicle V3 from module 81. Thus, the Janky reference does not disclose

deriving a target crossing location of the detected vehicle V3 on a baseline defined by two sensors both sensing the detected vehicle, where the target crossing location is derived from range signals from both sensors. Rather, Janky uses the more expensive module 83 providing bearing angle and bearing angle rate signals, which module is capable of doing the job all by itself without any assistance from modules 81 or 85.

The situation is the same for module 85 and vehicle V4 on a road approaching vehicle V1 from the left, which is described from column 11, line 18 to column 13, line 19. Again, the equations first applied are those using the bearing angle, in this case ø(t;1;4), provided by module 85. Again, the only module from which signals are received and used by the equations of the algorithm is module 85, which does the entire job by itself with no signals from modules 81 or 83.

Applicants assert that anticipation of applicants' claimed invention requires more than a reference merely showing multiple sensors on a vehicle. An anticipating reference must show clearly and unambiguously two sensors both configured to sense the same object over the same time period and each providing at least range signals for the object (and in one of the embodiments, both range and range rate signals. In the Janky reference, it is clear that modules 83 and 85, being on opposite sides of vehicle V1, do not have a common field of view. In addition, since modules 83 and 85 are each on a different side of vehicle V1 and only described as sensing an object on that side of the vehicle, while module 81 is described as being on the front of the vehicle and only described as sensing an object in the same land ahead of the vehicle, there is no clear and unambiguous teaching of module 81 having a common field of view with either of sensors 83 and 85. Any statement to the contrary by Examiner is based on speculation, not on the reference itself, and provides no support for an anticipation rejection based on 35 USC 102(b).

Thus the Janky reference does not disclose the following recitations of applicants' independent claim 23. In this quoted passage, the words in square brackets are not a direct quote but are a summary of a portion of the claim that is omitted here to be discussed separately at a later point.

> ...a first sensor configured to sense an object in a field of view and provide signals of a first range, defined as the distance between the object and the first sensor, and a first range rate thereof;
>
> a second sensor configured to sense the object in the field of view and provide signals of a second range, defined by the distance between the object and the second sensor, and a second range rate thereof, the sensors defining a baseline and the field of view being a common field of view for the first and second sensors; and
>
> a processor configured to:
>
> receive a plurality of paired range and range rate signals for the sensed object from the first sensor and a plurality of paired range and range rate signals from the second sensor over a time period;....and
>
> derive [by a recited algorithm from the received range and range rate signals] an estimated target crossing point location along the baseline as a distance from a predetermined point on the baseline....

If Examiner still believes that such a two sensor and processor arrangement (regardless of the details of the algorithm) is disclosed in Janky, applicants respectfully request that Examiner point out its particular parts and explain the application of applicants' recitations to it in a clear and unambiguous manner.

Applicants assert the same for claim 28, except that range rate signals are not recited as required.

But even if such a sensor arrangement were shown in the Janky reference or some other reference, the Janky reference still does not describe a processor configured with either of applicants' signal processing algorithms as recited in claim 23 and claim 28. This should not be surprising, since both the

signals provided to applicants' processor and the output of applicants' processor are different from those of Janky's processor. Applicants provide only range (or range and range rate) signals from two sensors separated on a baseline and outputs an estimated target crossing location on that baseline, but requires the signals from both sensors. In contrast, Janky et al provide (in addition to range and range rate) bearing angle and bearing angle rate signals from a single sensor and output different information: such as whether the lateral component of velocity between the sensed vehicle V3 and the sensor carrying vehicle V1 is within a first, second or third range (reference numbers 113, 115, 117 of Figure 5) or similar information for the longitudinal relative velocity (reference numbers 125, 127, 129).

Here are additional recitations from independent claim 23 of applicants' configured processor that are not disclosed in the Janky reference. In reading these recitations, Examiner should note that (1) each paired set of range and range rate signals from a sensor refers to a range signal and range rate signal characterizing the sensed object at a single time and (2) each of the first and second paired sets of range and range rate signals is recited as being derived from a different one of a pair of separated sensors on the vehicle.

> ...for each of the received paired range and range rate signals received over the time period, compute a W-plane point representing a square of the range and a square of the product of range and range rate, wherein the W-plane is a two-dimensional Cartesian coordinate system with a first axis representing the square of range and a perpendicular second axis representing the square of the product of range and range rate....

This refers, for example, to a conversion with a result as shown in shown in applicants' FIG. 5 or FIG. 7, with points 64 of the W-plane each representing a pair of numbers, one of which is the square of range and the other of which is the square of the product of range and range rate. The Janky reference shows nothing like applicants' W-plane in either graphical or numerical form.

> ...generate a best fit, first W-plane curve from the w-plane points derived from the first sensor and a second best fit, W-plane curve from the W-plane points derived from the second sensor....

This refers to creation of a best fit curve such as curve 66 of applicants' FIG. 5 or curves 66A and 66B of applicants' FIG. 7, shown as a linear curve although the claim is not limited to strictly linear curves. The Janky reference shows nothing like these best-fit curves in the W-plane, in either graphical or numerical form.

> ...calculate a numerical difference between values on the first and second best fit, W-plane curves at a selected value of the square of the product of range and range rate....

This refers to a difference such as difference V between curves 66A and 66B in applicants' FIG. 7 in a direction parallel with the R^2 axis of the W-plane, shown as parallel curves although the claim is not limited to strictly parallel curves. The Janky reference does not compute such a difference in either graphical or numerical form.

> ...derive an estimated target crossing point location along the baseline as a distance from a predetermined point on the baseline, the distance being derived from the numerical difference and the separation distance of the first and second sensors....

The derived estimated target crossing point is located on the baseline defined by the two sensors, both present on a single vehicle and sensing the same object over the same time period. Applicants show such a baseline as axis y of applicants' FIG. 2. The point may lie between sensors 12A and 12B, to the left of sensor 12A or to the right of sensor 12B. It is clear from this Figure, together with applicants' FIG. 1, that the estimated crossing point may provide a useful indication, not only of whether or not a collision may be imminent, but approximately where this collision is likely to take place on the vehicle. As

previously stated, the Janky reference shows no such derivation of an estimated target crossing point on such a baseline.

Finally, the processor is recited as being configured to "generate a signal based on the estimated crossing point location."

Similarly, applicants' claim 28 recites a processor configured to:

> ...filter each range signal with a range tracking filter...

This refers to applicants' range tracking filters 100 and 102 as shown in applicants' FIG. 8 and step 126 of the flow chart shown in applicants' FIG. 9, with accompanying text. The Janky reference shows no such range tracking filter processing sensed range signals from the sensors.

> ...calculate a numerical difference between squares of the filtered values of the range signals from the first and second sensors...

Janky does not calculate a numerical difference between squares of filtered range signals from first and second sensors sensing the same object (and in particular where the filtering is performed in a range tracking filter).

> ...derive an estimated target crossing point location along the baseline as a distance from a predetermined point on the baseline, the distance being derived from the numerical difference and a separation distance of the first and second sensors...

As previously explained with respect to the identical recital of claim 23, the derived estimated target crossing point is located on the baseline defined by the two sensors, both present on a single vehicle and sensing the same object over the same time period. Janky does not show this.

Finally, as with claim 23, claim 28 further recites the processor as being configured to "generate a signal based on the estimated crossing point location."

Applicants repeat their request that, for any recitation of applicants' claims asserted by applicants as not being disclosed in the Janky reference that Examiner believes is disclosed in the reference, Examiner provide specific identification of each anticipating item in the disclosure, together with such explanation as is required to presenttheircase for anticipation in a clear and unambiguous manner. A blanket reference to two columns of text with no other identification or explanation will, in most cases, not satisfy this request.

The rejections of the office action were based entirely on anticipation under 35 USC 102(b). However, applicants wish to point out that, because all two dimensional processing of signals from the sensing modules in the Janky reference begins with the use of bearing angle and bearing angle rate of the sensed object, and whereas a primary object of applicants' invention is to estimate a target crossing point of the object without receipt or use of such angle or angle rate information from the sensors, the Janky reference clearly teaches away from applicants' claimed invention and is, by itself, an insufficient basis for a 35 USC 103 obviousness rejection.

Thus applicants request withdrawal of all rejections of the prior office action and allowance of the presented claims.

Respectfully submitted,

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